How to Promote, Demonstrate and Implement Sustainable Development in the N.C.C. Greenbelt and Beyond

DISCUSSION PAPER

Phase One of Future Greenbelt Project:
Policy Realm

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II. EXECUTIVE SUMMARY

This report outlines the potential of N.C.C. Greenbelt policies to promote, demonstrate, and implement sustainable development (SD) within the National Capital Region and beyond. In fact, an integrated management approach involving other stakeholders to further the imperatives of SD is suggested.

SD is presented as a significant, increasingly normative, bottom-up concept - the wave of the future. Its focus has shifted from stressing environment-economy integration to human development, i.e. greater autonomy of the individual and of communities. Although SD may be described as a journey rather than a destination, some development processes can be proven to be more sustainable than others (for example, promoting biological diversity rather than practicing monoculture in agricultural or forestry systems).

The traditions of allocative, innovative and radical methods of planning all have a role to play in implementing SD. These planning traditions are used to classify recommendations by the World Commission on Environment and Development (Our Common Future), the World Conservation Strategy I and II, and the State of the World Reports - the standard literature on SD. Canadian responses to these reports are examined, and approaches to implement SD in the Greenbelt extracted.

A conceptual framework for decision-making to implement SD is proposed which draws from the allocative, innovative, and radical planning traditions. Goals of SD (suggested in an earlier N.C.C. report) in the areas of bio-physical, socio-cultural, and economic systems are supplemented with examples of applications to the Greenbelt. Finally, a sectoral breakdown elaborates on SD principles and strategies for the agricultural sectors, conservation areas, forest reserves, and recreational as well as commercial sectors.

III. SUMMARY OF RECOMMENDATIONS

(For Implementing SD Principles in the Greenbelt by Sector)

1) Agriculture: Western, Southern and Eastern Farm Sector (in particular)

Principles:
1) Provide information on and incentives for sustainable farming practices;
2) Apply an agro-ecosystem approach;
3) Practice sustainable harvesting of fertile soils, (especially cultivating methods);
4) Increase diversity of crops;
5) Minimize use of chemicals - practice integrated pest management within the GB (IPM);
6) Increase production for local needs - aim for self-sufficiency in produce for the National Capital Region;
7) Consult GB farmers about these objectives and their individual implementation.

2) Conservation Areas: Stony Swamp and Mer Bleue

Principles:
1) Demonstrate ecosystem (specifically: wetland) value for present and future generations;
2) increase public awareness of ecosystem sensitivity and vulnerability (for example, min. viable populations concept);
3) show fallacy of trying to separate natural from 'man-made' environments (i.e., cities as ecosystems);
4) control public access;
5) monitor ecosystem integrity.

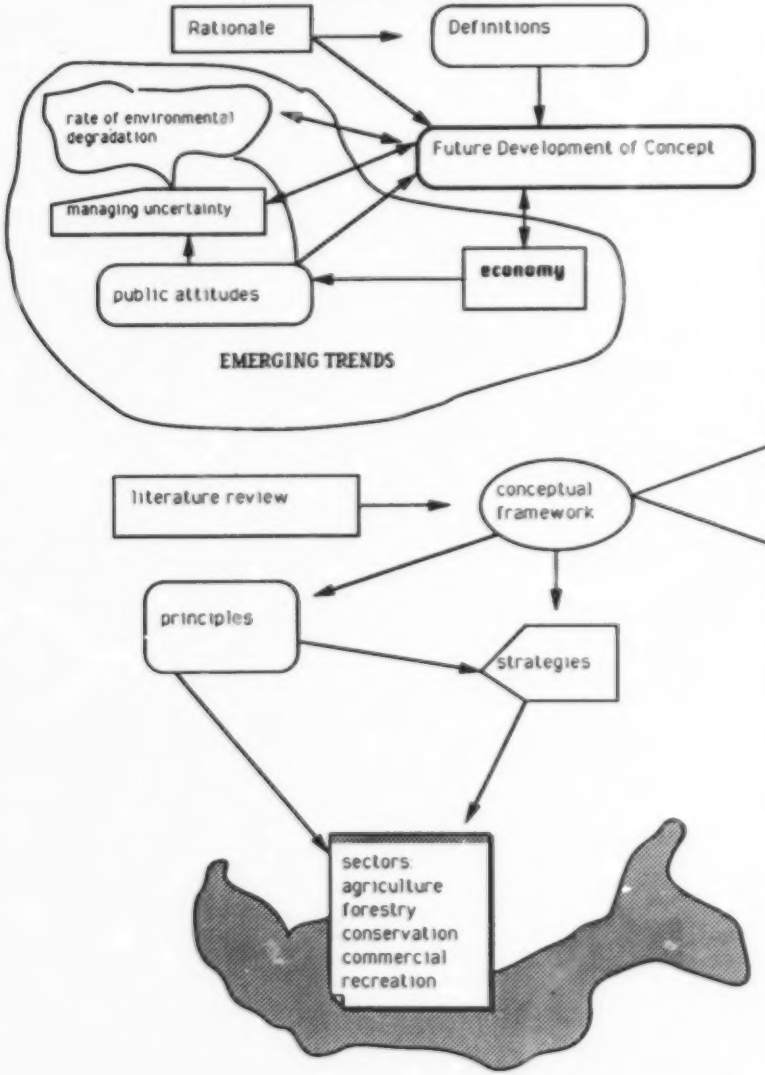
3) Forest Reserves: especially, Pinhey Forest Reserve and Pine Grove Sector

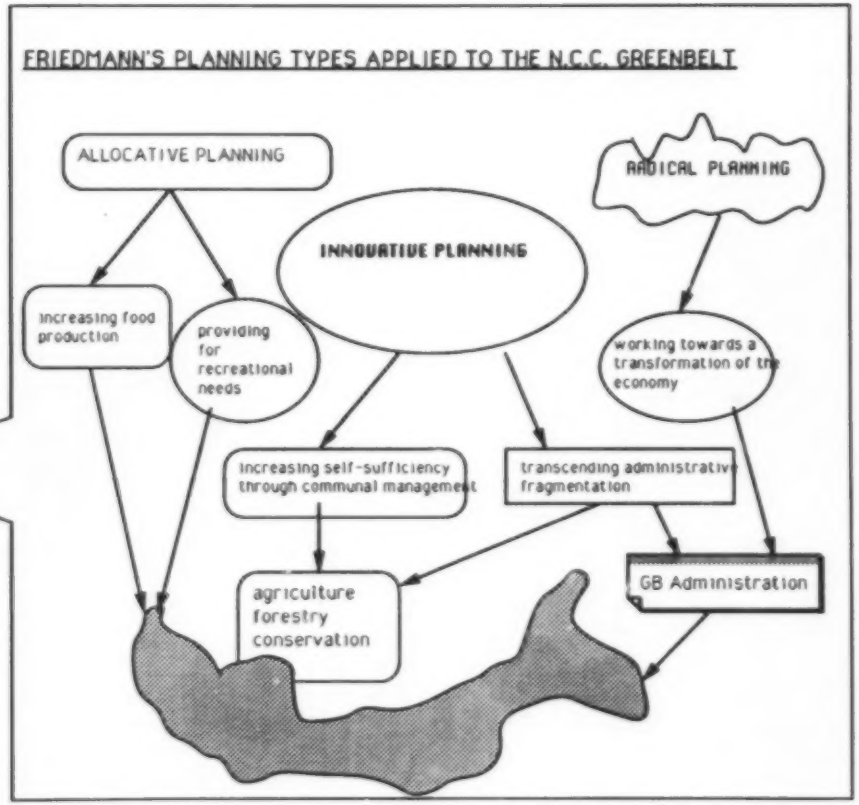
Principles:
1) Demonstrate benefits of vegetation (esp. forests) to humans in an urban environment;
2) Foster an appreciation of forests as valuable ecosystems rather than as a renewable resource;
3) Maximize biological diversity in stocks;
4) Protect old growth forest;
5) Maintain tree and brush cover for small mammals and birds to retain optimum viable populations in forest stands;
6) Minimize the use of herbicides and fungicides in forest tending practices;
7) Involve the general public in forest management.

4) Recreation / Commercial: especially, Bruce Pit Sector and Shirleys Bay

Principles:
1) Teach environmentally responsible behaviour;
2) Demonstrate compatibility of SD with culture and values of people;
3) Show that SD is a realistic alternative to present energy-intensive ways and makes for good business;
4) Demonstrate how SD can increase people's control over their lives;
5) Popularize SD as an example for other ecozones across Canada.

OPERATIONALIZATION OF SUSTAINABLE DEVELOPMENT IN THE N.C.C. GREENBELT





1. Introduction

As a consequence of the 1986 mandate renewal (see Appendix IV), the N.C.C. seeks to clarify the significance and role of the Greenbelt (GB) in a manner which is philosophically in line with the environmentally conscious 1990s.

The purpose of the Future Greenbelt Project is to develop a long-range strategic management plan for the National Capital Greenbelt. The project contains three stages: the project report stage, the future GB land use concept stage, and finally implementation by the National Capital Commission and stakeholders. Stage I involves research of background information on the physical resources of the GB, examination of issues relating to its roles and uses, identification of trends which will affect it in the future, and future role definition. Project initiation involves two main components: the physical and policy realms.

Sustainable Development (SD) is one of the major thrusts of the coming decade for Western societies. Broadly conceived, the call for SD resonates with the rise of new understandings of environmental systems, technology, social organization, knowledge, values, and their interplay (Norgaard, 1988). As such, its potential ramifications on the future GB must be identified. This report thus forms one of several elements in the second component of stage I - policy analysis. It seeks to address the following objectives:

1) An assessment of the concept of SD... specifically, the rationale for it and where it might evolve to in the future;
2) analysis of SD definitions in order to determine a suitable interpretation for the GB; this includes a review of relevant literature;
3) derived from the literature on SD, development of underlying principles in which to place future policy for the GB plan. This includes not only the functions of the land base and its use, but also of the processes of planning and management which will promote sustainability;
4) examples of potential policy applications and specific strategies for the GB which could be incorporated into the long-range strategic management plan.

2. The Concept of Sustainable Development

The Rationale for Sustainable Development

Throughout the 1980s it has become clear that conventional notions of what development entails need to be revised. As a result of unfettered economic growth in the developed countries, and desperate measures to escape the poverty trap in developing countries, environmental degradation has accelerated at an alarming rate. The author of a previous N.C.C. report on SD summed it up thus:

> "... public attention is becoming increasingly focussed on the harmful effects of many of man's activities on his environment, from a global right down to a local level. Atmospheric warming, ozone depletion, soil erosion, and species extinction are but a few examples of

> global-scale problems we now face. Closer to home, garbage disposal, air, water, and soil pollution, urban sprawl, and acid rain represent pressing issues (Billingsley, 1989)."

Among many experts a consensus has evolved that economic and environmental considerations, hitherto see as diametrically opposed, have to be linked to ensure humankind's long-term survival. SD purports to do just that. As such, the concept has been subject to various and occasionally contradictory interpretations - especially since being popularized by the 1987 report of the World Commission on Environment and Development (WCED), entitled "Our Common Future." The danger exists that SD could become a term so vague as to mean all things to all people, yet nothing at all.

Definitions of Sustainable Development

The concept of SD needs to be made more concise, systematic, and rigorous, before it can be usefully applied in policy-making and planning (Barbier, 1987). There are a host of technical definitions. For simplicity's and intelligibility's sakes, I shall limit discussion to the shorter, less technical ones provided by Brundtland (Our Common Future), Munro (World Conservation Strategy) and Brown (State of the World Report).

Arguably the most concise and 'best recognized' definition to date has been provided by the first of the three, the report of the World Commission on Environment and Development:

> "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1987)."

But problems of assessing just what constitutes 'not compromising the needs of future generations' have rendered this definition almost meaningless for purposes of implementing the concept of SD. The legitimate question also suggests itself whether the realization of SD principles does not require substantial changes in values. It appears that at least some customs will have to be altered if lifestyles are to be made sustainable.

An alternative is supplied by the draft of WCS II - this document gives a more normative (rather than prescriptive) definition:

> "A process of social and economic betterment that satisfies the needs and values of all interest groups, while maintaining future options, and conserving natural resources and diversity (Munro, 1989)."

What further sets this summary apart from earlier versions is its emphasis on human improvement (i.e., stress on quality of life) rather than purely economic growth - although the WCED also mentioned 'changing the quality of growth.' Munro thus implies that adjustments in the social as well as the economic realm are warranted on the path towards a truly sustainable society. The authors of WCS II go on to outline four kinds of sustainability: ecological, social, cultural, and economic.

An earlier N.C.C. paper categorized goals of SD according to three systems: biophysical, socio-cultural, and economic (Billingsley, 1989). In elaborating, its author adopted the WCS definition of cultural sustainability: "... compatible with the culture and values of the people affected." However, changes in values might be necessary in some cases. The 1990 edition of the State of the World Report states the difficulty bluntly:

> "Because of the strain on resources its creates, [Western-style] materialism simply cannot survive the transition to a sustainable world (Brown et al, 1990)."

It follows that a true concern for the environment might indeed involve rearranging some of the economic utilitarian premises our culture now so freely and often unthinkingly applies (see also Norgaard, 1988). At the same time, there are no magical 'recipes' which could be applied across all cultures and ecozones.

The State of the World Reports have not come up with a concise, specific definition of SD. The 1989 edition, however, discusses philosophy and aspects of development per se:

> "Real development is the process whereby individuals and societies build the capacity to meet their own needs and improve the quality of their own lives. Physically, it means finding solutions to the basic necessities of nutritious food, clean water, adequate clothing and shelter, and access to basic health care. Socially, it means developing the institutions that can promote the public good and restrain individual excess (Brown et al, 1989)."

These quotes show progressively greater normative (as opposed to value-free) content than the initial Brundtland delineation of SD. What implications does this have for the future of the concept as a whole?

The Future of SD

From the above discussion we can conclude that SD as a concept is not something fixed and ready-made. To many, it constitutes change in values within society as well as a call for action. In the words of William E. Rees, it requires "a proactive [rather than reactive] approach in which ecological integrity is the governing factor" (Rees, 1990). Like science itself, SD is open-ended and subject to revision as more knowledge about environmental processes is gained. Some writers have questioned the political and intellectual coherence of SD (for example, Tomalty, 1989). Others have stressed the need for significant changes in beliefs and behaviour before SD can acquire any real meaning (Norgaard, 1988; Rees, 1990).

Such reservations should not be taken to mean that we can sit back and adopt a wait-and-see attitude. Rather, deterioration of our natural environments and resulting changes in our attitudes are happening now. Building on the evolution of knowledge and sensibility, decisions on environmental impacts of development have to be made continuously. SD cannot be labelled as 'a

passing fad' if humankind is to survive the next 50 years. A framework for action is needed.

The rate of societal and environmental change is accelerating. Predicting the future even 20 years down the road is extremely difficult. Nevertheless, different scenarios can be projected to cover a range of possible futures. For SD, the future appears to depend on four (not mutually exclusive) major factors:

1) **The rate of environmental degradation.** In Canada today, the risk of contracting skin cancer is 15 % higher than before 1982 - due to the depletion of the ozone layer (Bregha and Bond, 1990). This and other examples give support to the claim that breakdown of natural processes occurs when certain threshold levels of tolerance are exceeded, and then at a much quicker pace than previously thought. Evidence suggests that the 'carrying capacities' of ecosystems might be permanently reduced once their capacity has been overtaxed and suffered a collapse (for example: Boughey, 1976). Further environmental degradation is likely to advance the cause of SD - by increasing the sense of urgency (read: potential for social destabilization).

2) **Managing uncertainty.** We still know very little about potential impacts of human activities on the environment - and how the environment functions. Complicating factors are time, space (topography, watersheds, wind patterns), climate (seasonal variations included), and their interactions with other natural or man-made phenomena. Our most sophisticated measuring tools still have trouble simulating "real-world" conditions, due to the staggering complexity of natural systems (Beanlands and Duinker, 1983; de Broissia, 1986). Science and technology might be useful for outlining the boundaries of SD, but they can never lie at its heart. It appears safe to say that there will never be a 'simple' solution to determine exactly what amount and what kind of development is sustainable.

   Notwithstanding this, we have to make development decisions in the quest to supply a growing population in the face of a finite resource base. It would appear to be wiser to err on the side of caution, for err we will. But the onus of proving development to be sustainable should rest with those who develop, not with those affected by development. Despite the previously mentioned caveats, scientists can provide developers with knowledge to arrive at more farsighted decisions. Scientific breakthroughs can increase decision-makers' confidence in long-term strategic planning. Such planning is likely to grow more 'sustainable.'

3) **Public attitudes.** For better or for worse, economic and environmental policies reflect public attitudes. Policies usually lag slightly behind, due to decision and execution lags. However, there are signs that political systems are growing more responsive. The public as well is growing more educated and activist - as testified by last year's quick collapse of Communism in Eastern Europe. Thus, the gap between 'leaders' and followers seems to be narrowing. Yet, most people remain unaware of some less publicized

salient environmental problems. Soil erosion is a case in point (Sparrow, 1984).

People who see their own and their children's future imperiled are more willing to make sacrifices in the interest of long-term sustainability than people who do not. Concern in Canada and elsewhere seems to be at an all-time high. Barring unexpected deterioration in socio-economic conditions due to an extreme recession or war, this concern is likely to continue.

For reasons outlined in point 2, politicians rather than scientists in Canada are likely to continue setting the agenda with regard to SD - responding to public pressure, while possibly continuing to 'balance' the concept with other interests. The expected all-embracing nature of the changes to be made might intimidate many decision-makers (Bregha and Bond, 1990). Implementation of SD policies will require new skills, different methods of analysis, new attitudes and values, and consultation with new stakeholders. But the publicly perceived urgency of the task conflicts with the conventional politician's tendency to 'play it safe.' The result might be delays in implementation - especially of comprehensive, long-term SD strategies.

4) **The economy.** The business cycle will probably continue to fuel investments for the next 20 years. Short-term profits and long-term sustainability will continue to clash in many cases. If a prolonged recession hits, important Canadian environmental initiatives could still easily be derailed. Competitive pressure has the potential to interfere with attempts at comprehensive environmental management even in the best of times, particularly as the globalisation of the economy increases. When times get worse, SD as a concept could become marginalized by economic decision-makers facing tight budgets and/or cash flows.

   On the other hand, environmental education might have served to fully internalize ecological concerns in the management of the economy 20 years hence, thus overcoming continuing 'fiscal restraint.'

Perhaps, the main issue is not whether SD in its present form is intellectually coherent. As our knowledge base and insight into natural processes grow, people will make it so - or replace it with another concept which satisfies the dictates of reason and practicality more fully. As a species, humans alone have the capacity to reason and plan ahead for future generations. Some say that mankind is evolution grown conscious of itself. If this premise is accepted, one also has to accept the responsibility that comes with it. We alone have the power to alter ecosystems rapidly and irreversibly. Human planning, therefore, has to consider the needs of organisms other than humans.

Ecoplanning, a term coined by the late Robert S. Dorney and applied before by McHarg in "Design With Nature," has to replace conventional cost-benefit planning (Dorney, 1989). Van Riet and Cooks provided a recent outline of an ecological planning model (Van Riet and Cooks, 1990).

Emerging Trends

Looking at events of the last decade, a few trends in the evolution of the concept of SD become discernible. Firstly, SD as a term today is applied more broadly than ten years ago - as we have seen. Whereas early definitions hinged almost exclusively on environment-economy integration, later ones have included social justice, democracy, and human dignity (for example, Munro, 1989). Human development has become more prominent, and economic development a means to achieve the former, rather than an end in itself.

Secondly, mental distinctions between human and natural environments are gradually breaking down. This is due to increasing recognition of the fact that cities and countrysides all have their own dynamic ecosystems. Virtually all human actions have consequences for the environment. What happens in the metropolis affects the hinterland (CO_2 emissions, acid rain, garbage disposal, etc.). The debate between developers and conservationists is growing less polarized in some cases. Canadian industry has joined the drive towards 'sustainable economic development.' Thomas d'Aquino, President of the Business Council on National Issues, has publicly admitted that "corporations have an enormous responsibility to subject their activities to an environmental litmus test in order to help propel society toward long-term sustainability (d'Aquino, 1989)."

Thirdly, SD is not exclusively the responsibility of government and industry. All members of society can play a role in its realization. The slogan "think globally, act locally" finally seems to be penetrating the public consciousness. People in Canada and other 'developed' nations are gradually changing their consumption habits. A sustainable society does not merely prefer environmentally friendly products, it also seeks to reduce overall waste. Municipalities are beginning to implement recycling programs and other environmentally conscious measures. SD today has evolved into more of a bottom-up than a top-down concept.

Fourthly - and this is derived from the last point - SD as a concept is moving from the abstract to the concrete. Progressively more emphasis has been laid on action. Perhaps, even the individual's understanding of SD remains less important than his/her attitude. Lack of comprehension of detailed natural processes does not preclude respect for them. Everyone can plant trees, start a compost pile, reduce their energy consumption. Where there is a will, there is a way. In a Third World context it has been argued that real development is people-led, rather than funding-led (Brown et al., 1989). And Canadian schools today tend to stress action-oriented environmental education.

Given that the necessity of a change in attitudes is accepted as a first step on the path to a truly sustainable society - how would such a change be implemented in the management of and long-range planning for the Greenbelt? It has to be realized that planning itself (and particularly, strategic planning) is not a value-free endeavour. Indeed, principles and strategies for future GB

management can be derived from different schools of thought. John Friedmann has summarized the most relevant planning traditions in a concise fashion. I shall use his typology to distinguish the approaches advocated by Brundtland, Munro and Brown. Based on that classification, principles as well as strategies for the future management of the GB can be extracted (at different levels of intervention). A conceptual framework for action in the GB can thus be established.

3. SD as a Means of Strategic Planning

SD principles can be applied in the procedural as well as substantive planning stages. I shall attempt to demonstrate how they might be applied with the aid of a widely used planning text. In his book "Planning in the Public Domain," Friedmann identifies four forms of planning: allocative, innovative, radical planning and practice, and revolutionary practice:

> Allocative planning is concerned with the central disposition of scarce resources (incl. land) among competing claimants or uses. Innovative planning is concerned with institutional change in the system of societal guidance. Radical planning is distinctive in drawing on organized citizen power to promote projects pointing toward social transformation (Friedmann, 1987).

Allocative planning is roughly comparable to economic planning by the Canadian federal and provincial governments. Examples would be equalization and transfer payments to regions and individuals. Therefore, allocative planning could be used to help those who are financially and socially disadvantaged. In the GB, for example, this could be done by providing incentives for more sustainable forms of land use.

The setting up of the Canadian Task Force on Environment and Economy would be an example of innovative planning. Such action - initiated by political decision-makers - thus seeks to transcend the administrative status quo. Notwithstanding the legitimate criticisms by Tomalty and Rees, the CTFEE did so by a holistic rather than sectoral approach to the country's economic and environmental problems. This approach applied to the GB might mean, for instance, that certain future GB management functions could be carried out by a board of directly affected parties with an interest in its success as a vehicle for demonstrating the practicality of SD.

Radical planning seeks to achieve change through grass-roots action. People outside existing institutional set-ups thus can become involved in planning activities. Land claims of Canada's aboriginal peoples, specifically the drive to create Nunavut (a new administrative unit in the Northwest Territories), would be a case in point. In the GB, grass-roots action could involve marketing of organically grown produce and development of low-tech approaches to reduce Canada's exorbitant per capita energy use.

Friedmann's classification is useful to distinguish between approaches taken by international and federal-provincial initiatives to achieve sustainable

development and could thus indicate which initiatives might be appropriate to which situation in the GB. Without mentioning SD in the book, in Friedmann's view, planning which is carried out and implemented over the heads of people affected by it does not seem to be 'sustainable.' All planning must confront the problem of how to make technical knowledge more effective in informing public actions (Friedmann, 1987). Consequently, each of the above mentioned forms of planning can play a legitimate role in the incorporation of SD into future GB management.

4. SD Principles / Areas of Intervention

Review of Relevant Literature

This section analyzes relevant literature to determine potential management approaches for the Future GB Project. Recommendations for sustainable practices in forestry, agriculture as well as research and development (R&D) are particularly highlighted to correspond with land management designations in the 1982 Management Plan for the GB.

To date, the most important publications in the field of sustainable development are "Our Common Future," the "World Conservation Strategy," and the State of the World Report Series (especially the 1990 edition). These will be discussed along with Canadian responses to calls for implementation of SD principles.

The analysis of each document is structured as follows:

a) underlying principles;
b) Canadian responses to these principles;
c) issues highlighted with relevance to the GB;
d) implications for GB strategies by sector;
e) conclusions.

Brundtland Commission Report
Underlying Principles

To this date, "Our Common Future" enjoys a reputation for being the standard report on SD. After the first World Conservation Strategy in 1980, this book is only the second to take a holistic and global approach to address the environmental predicament we find ourselves in. Reflecting UN membership, the WCED (as the Brundtland Commission will be referred to hence) takes a hard look at Third World problems, but also makes linkages to developed nations.

The Commission went out of its way to solicit opinions from people around the globe - the advantaged and the disadvantaged. Quotes by 'speakers from the floor' are highlighted throughout the book. This egalitarian outlook makes "Our Common Future" essentially a product of the innovative 'social learning' process (Friedmann, 1987).

The report consists of three main parts: common concerns, common challenges and common endeavours. Thus, SD in the hands of these authors becomes an integrative concept: "Economy is not just about the production of wealth, and ecology is not just about the protection of nature; they are both equally relevant for improving the lot of humankind (pp. 37-38)." In the eyes of WCED, environment and economy are 'inexorably' linked (p. 37).

For the WCED, strategic imperatives for environment and development policies which follow from the concept of SD include reviving growth; changing the quality of growth; meeting essential needs for jobs, food, energy, water and sanitation; ensuring a sustainable level of population; conserving and enhancing the resource base; reorienting technology and managing risk; and merging environment and economics in decision-making (p. 49).

Canadian Responses to these Principles

The Canadian International Development Agency (CIDA) anticipated the Brundtland Commission in some respects. Ten years before publication of the WCED's report, Dr. George Francis lamented "the undue centralization of government institutions combined with narrow pursuit of single sector policy objectives (Francis, 1978)." To be sure, this comment applied to the Third World - but is equally relevant in a Canadian context.

In 1987, the National Task Force on Environment and Economy (NTFEE) was put together in response to the Brundtland Report. Its recommendations constituted almost exclusively allocative planning measures. They cannot be said to comprise a strategy, for their vagueness renders them short on procedural or substantive content. An example is provided by the following quote:

> "Canada should explore and promote mechanisms to ensure that environmentally sound economic development is an important component in... negotiations dealing with development and trade (p. 15)."

The authors do not elaborate on how this is to be achieved, nor do they list examples. Tomalty argued that the Task Force watered down the recommendations of the Commission considerably (Tomalty, 1989). The NTFEE stressed Sustainable 'Economic' Development in its report. This narrowing in focus excludes certain attitudinal changes required to make SD work. The consequences become obvious in the following passage:

> Sustainable economic development does not require the preservation of the current stock of natural resources or any particular mix of human, physical, and natural assets (NTFEE, 1987).

Thus, a much more anthropocentric (i.e., human-centred) view of SD emerges. In rebuttal, Rees lamented the "pathology of current economics-environment integration." He cautioned that nearly 40 percent of terrestrial net primary

productivity (net biological production) is already being used or co-opted by humans, and the fraction is steadily increasing. (Rees, 1990)

Notwithstanding such problems, the NTFEE made one fundamental contribution to the advancement of SD in Canada. It stipulated that environmental protection must involve all (federal) ministries - not just the Department of Environment. The Task Force Report is representative of many similar governmental initiatives in Canada. Environmental policy as a whole remains in a state of infancy. Ecological integrity still has a hard time establishing itself as a governing factor in the face of powerful pro-industrial interests. Conventional standard operating procedures and policies sometimes end up at crossroads with new environmental initiatives. Thus, environmental considerations still often remain an afterthought rather than the basis of political decision-making.

This dilemma has been recognized and criticized by Environment Canada. The publication "Environment and Development: A Canadian Perspective" contained the phrase: "Clearly, the remedial approach to environmental issues is not enough.... it does not go back to basic causes (Environment Canada, 1987)." Unfortunately, for other federal government departments, business seems to continue as usual. For example, the Friends of the Earth listed the National Wheat Board's incentives for expansion of cropland irrespective of environmental consequences - read: drying up of wetlands - as a case in point (Greenprint for Canada Committee, 1989).

In June of this year, the Interdepartmental Workshop on SD in Federal Natural Resource Departments published a draft entitled Implementing Sustainable Development, which contains more specific recommendations than the NTFEE's publication (Bregha and Bond, 1990). The draft identifies four main substantive and procedural constraints:

1) knowledge, research and methodological;
2) organisational structure;
3) bureaucratic processes and procedures;
4) attitudes and values.

The first constraint is broken down into three main parts: insufficient guidelines and knowledge, methodological constraints, and bias in economic analysis. The authors lament that very few federal policies, programmes and practices so far have been assessed for their environmental impact. Lack of a clearly established methodology to integrate environmental and economic data sets and the absence of SD indicators are also presented as problems. Discount rates are criticized for favouring projects with short term benefits and neglecting long-term environmental degradation.

The second constraint (divided into organisational structure and jurisdictional split) targets the inhibition of integrated policy formulation by segregating environmental considerations in different departments. The authors argue that economic development agencies have generally not been held fully

accountable for the environmental implications of their activities. However, the Green Plan and the reform of the federal environmental assessment process are seen as clear departures from past practice.

The third constraint deals with lack of clear objectives, budgetary restraint, information access, crisis management, inadequate enforcement, and lack of accountability and absence of incentives. Budgetary restraint could set back progress of the Federal Environmental Assessment and Review Office (FEARO) in consolidating strategies for SD. FEARO has estimated that a 50% increase over current expenditures would be needed to implement the environmental assessment and review process (EARP) fully under the existing order-in-council. A further doubling of resources would have to take place to implement a legislated process.

The fourth and final constraint is about societal will and fear of change. The authors see some hope that strengthening public concern "implies that Canadians are less willing to discount the future than they used to." They caution that technical fixes are not at the core of an SD strategy:

> This was the conclusion from at least two of the discussion groups who emphasized the importance of enhancing human dignity and self-respect, fostering a sense of pride or community and the empowerment of local citizens as key ingredients in SD strategies (Bregha and Bond, 1990).

Thus, the participants of this workshop (a selection of representatives of Agriculture Canada, CIDA, Environment Canada, EMR, FEARO, Fisheries and Oceans, Forestry Canada, and Indian and Northern Affairs) finally openly acknowledged the progressive nature of some of the Brundtland report's recommendations.

Implications for GB Strategies

Elaborating on the second imperative (quality of growth), the WCED argues that SD requires growth to be made less material and energy-intensive and more equitable in its impact (p. 52). Economic development, it is claimed, must take full account of the improvement or deterioration in the stock of natural resources (p. 52). Under the heading 'conserving and enhancing the resource base,' the WCED talks about environmental management in greater detail. Land use in agriculture and forestry should be based on a scientific assessment of land capacity, and the annual depletion of topsoil, fish stock, or forest resources must not exceed the rate of regeneration (p. 57). These guidelines could be applied for future GB management decisions regarding forestry and agriculture. Also, integrating intersectoral management (i.e., the GB under one jurisdiction) provides a unique opportunity to do so.

Agricultural Sectors

Specifically, increases in agricultural productivity should be based on the better controlled application of water and agrochemicals - as well as more extensive use of organic manures and non-chemical means of pest control (p. 58). More efficient use of energy and resources becomes an ecologically as well as economically viable alternative to their conventional heavy taxing. Brundtland et al. conclude that a production system which respects the obligation to preserve the ecological base for development as well as technological systems which search continuously for new solutions are required by the pursuit of SD (p. 65). Consequently, low-tech 'threshold' approaches could be evaluated by some GB farmers of the future.

The WCED points out signs of crisis in the three main food production systems, industrial agriculture (capital/input intensive), Green Revolution agriculture (uniform, resource-rich and irrigated areas) and resource-poor agriculture (pp. 121-22). Neglect of the small producer and degradation of the resource base due to loss of soil resources, impact of chemicals, and pressure on forests are particularly stressed (pp. 123-27). To alleviate such symptoms, the book calls for a global increase in food production by 3-4 % yearly (p. 128). The N.C.C. could set a similar, albeit realistic, goal for food production within the GB.

With regard to agricultural land use, the report outlines three broad land categories to enhance the resource base:

1) enhancement areas, which are capable of sustaining intensive cropping and higher population and consumption levels;
2) prevention areas, which by common consent should not be developed for intensive agriculture;
3) restoration areas, where land stripped of vegetative cover has either totally lost its productivity or had it drastically reduced (p. 133).

The authors also see nothing wrong with clearing forests for farming, provided that the land is the best there is for new farming, can support populations which settle on it, and is not serving a more crucial function - for example, watershed protection (p.127). Watershed protection for GB agricultural sectors should certainly be a high priority.

Conservation Sectors

On the issue of conservation, Brundtland sounds populist again (i.e., like a radical planner): "Programmes to preserve forest resources must start with the local people who are both victims and agents of destruction, and who will bear the burden of any new management scheme (p. 136)." Therefore, communal involvement in and responsibility for management is seen as the key to implementation of the concept of SD. Residents of the NCR, especially those in the vicinity of the GB, could thus become more involved in management decisions. Such additional responsibility, if combined with environmental education, would likely increase overall commitment to principles of SD.

Turning to species and ecosystems, the WCED advances a primarily economic argument for conservation - listing them in the title as 'resources for development (p. 147).' Thus, the monetary value of genetic variability and germplasm material of species to agriculture, medicine and industry is spelled out. Only later on do the authors qualify their cost-benefit analysis by stating that aesthetic, ethical, cultural, and scientific considerations provide amply grounds for conservation (p. 155). But the bottom line remains; conservation pays! Having said that, the WCED acknowledges that the public puts a value on nature beyond the normal economic imperatives (p. 165). In the GB, non-consumptive use of natural areas should be stressed. At the same time, admission fees to areas like Stony Swamp and Mer Bleue might put the idea across that natural resources are not 'free.' Environmental education should drive this point home.

Commercial / Open Space Areas

In the field of energy, however, economic arguments for sustainability do not yet hold as much water. Economic and institutional constraints to the use of renewable energy resources are admitted to be 'formidable' in some cases (p. 195). The WCED concedes that a generally acceptable pathway to a safe and sustainable energy future has not yet been found (p. 169). Among key elements of sustainability which have to be reconciled:

- energy efficiency and conservation measures, such that waste of primary resources is minimized
- protection of the biosphere and prevention of more localized forms of pollution.

Brundtland et al. worry about accelerated climate change, suggesting a four-track strategy to deal with it: Improved monitoring, increased research, internationally agreed policies and adoption of strategies to minimize damage (p. 176). The N.C.C. could take a leading role in this by fostering use of soft energy options within commercial areas of the GB.

The potential of renewable energy is discussed. In comparison, solar and wind power come out on top. But no single approach is seen as a panacea; instead, steady transition to a broader and more sustainable mix of energy sources is advocated (p. 195). In conclusion, the WCED looks to the future: "Within the next 50 years, nations have the opportunity to produce the same levels of energy-services with as little as half the primary supply currently consumed (p. 201)." Obviously, this objective cannot be realized without innovative approaches to energy planning.

The report also addresses the role of industry. Resource and environmental considerations, its authors believe, will allow a steady reduction in the energy and resource content of future growth (p. 219). This goal can be realized by increasing the efficiency of resource use, reduction of waste, and encouraging resource recovery and recycling. Again, commercial areas within the GB

presents opportunities to practice what the WCED preaches here - by means of promoting low-tech 'threshold' technologies.

Conclusions

The two key concepts of SD for the WCED are:

1) the concept of needs, in particular the essential needs of the world's poor, to which overriding priority should be given;
2) the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs (p. 43).

Since the changes are to be implemented through existing institutional arrangements, point one represents a dose of allocative planning. Consequently, the notion of continuous economic growth is accepted - more rapid growth even called for (p. 89). This attitude has been criticized by Rees. On the other hand, the WCED cautions that living standards going beyond the basic minimum are sustainable only if consumption standards everywhere have regard for long-term sustainability (p. 44). This caveat could be communicated in environmental education programs in GB recreational areas.

The WCED stops short of calling for a radical transformation of society. The authors never explicitly question the growth paradigm we now live by, despite their hints at adverse consequences of continuing the resource-intensive ways of developed countries. If sustainability is to be based on equity, however, continued growth is required to help Third World countries catch up - and end desperate measures (like slash-burn agriculture) which destroys the resource base all people depend on.

Our Common Future remains an important document insofar as it set a trend towards greater global awareness of the juxtaposition of economic and environmental issues. Indeed, when it comes to ecology there are no national boundaries - we have to manage the global commons jointly. Though occasionally short on specifics (partially due to the scale of issues dealt with), the WCED calls for institutional and legal change in part III.

The proposed legal principles summarized in the appendix represent a dose of radical planning. For example, principle number one stipulates: "All human beings have the fundamental right to an environment adequate for their health and well-being (WCED, 1987)." Governments of even the most liberal Western-style democracies do not yet legally recognize such a right. Rather, they tend to stress the individual's personal responsibility for his/her health. This portion constitutes the radical element in the report - a bottom-up approach to SD.

World Conservation Strategy (1980)
Underlying Principles and Issues Highlighted With Relevance to the GB

Commissioned by the United Nations Environment Programme (UNEP), the first Conservation Strategy in 1980 sought to outline objectives of conservation and requirements for their achievement , as well as priorities for national and international action.

The strategy introduced three important priority requirements:

1) maintenance of essential ecological processes and life-support systems;
2) preservation of genetic diversity; timely collection of genetic material and its protection in banks, plantations, etc., in the case of off-site preservation; ecosystem protection in the case of on-site preservation;
3) sustainable utilization of ecosystems and species; this requires knowledge of the productive capacities of those resources and measures to ensure that utilization does not exceed those capacities (Munro, 1980).

Indeed, these tenets have been adopted by the Conservation Council of Ontario in its draft of an "Environmental Strategy for Ontario" (Conservation Council, July 1990). From these essential principles, strategies for the GB can be derived. In the case of agriculture, the WCS recommendation to reserve good cropland for crops has not usually been heeded elsewhere in Canada - as pointed out by Manning and others (for example, Manning 1986). Originally, the GB was conceived as a means to forestall haphazard urban growth. It can also be used to preserve agricultural lands near an urban centre for future generations.

The WCS sees protection of the watershed as the principal management goal for watershed forests and pastures. Pollution of the Rideau River has been well publicized - watersheds within the GB could serve as sources of clean, constant water for creek flows.

Genetic diversity in agricultural as well as conservation reserves of the GB should be a high priority for the N.C.C., if the following WCS statement is considered:

> "Preserve as many varieties as possible of crop plants, forage plants, timber trees, livestock, animals for aquaculture, microbes and other domesticated organisms and their wild relatives (Section 6)."

If possible, larger portions of the GB should be set aside for conservation. Needs of the ecosystems (plant and animal communities) should prevail over strictly economic considerations. Moreover, the WCS criticizes the fact that public participation in conservation and development decisions is seldom adequate (Section 13).

Canadian Responses to these Principles

Manning elaborated thus on the link between conservation strategies and SD:

> Conservation strategies are the framework for judicious use of our renewable resources and can be used as blueprints for sustainable economic development in the renewable resources sector (Manning, 1990).

Noteworthy remains the switch from SD to "SED," a common fate of the concept in Canadian authors' hands. Again, renewable resources are portrayed in conventional economic terms. Four years earlier, Pollard and McKechnie had published a document entitled 'World Conservation Strategy - Canada: A Report on Achievements in Conservation' - a response to the challenge posed by the WCS, yet not amounting to a blueprint for a unified national conservation strategy.

Among priority requirements, these authors particularly emphasized reservation of prime quality cropland for crops, adoption of management practices to maintain the productivity of cropland, grazing land and forests, and prevention of soil degradation and restoration of land where soils are already degraded (Pollard and McKechnie, 1986). Provincial soil and agricultural management programs are then introduced. Under Ontario's Soil Conservation and Environmental Protection Assistance Programme, soil conservation advisers are hired to work with farmers, and joint programmes with local conservation authorities are implemented. In the GB, closer liaison between such programmes, research and development centres, and farmers as well as foresters might lead to new breakthroughs in sustainable agriculture and forestry practices.

Pollard and McKechnie also stress protection of watersheds, and the value of wetlands in maintenance of essential ecological processes and life-support systems. Perhaps, incomplete conservation areas like Stony Swamp and Mer Bleue should be expanded if possible, i.e. swapped with ecologically less valuable sectors.

Under the heading 'preservation of genetic diversity,' the role of the Expert Committee on Plant Gene Resources for agriculture is highlighted. This Committee reports to the Canadian Committee on Crop Production Services and to the Canadian Agricultural Services Committee. Liaison with these agencies could have beneficial effects on future GB management of agricultural sectors.

The report mentions establishment of a comprehensive network of protected areas as another priority requirement, for the purpose of securing the habitats of threatened, unique and other important species, unique ecosystems, and representative samples of ecosystem types. Consequently, management of GB conservation sectors could be coordinated with provincial and federal agencies to benefit the proliferation of certain indicator species. Crucial wildlife corridors within and outside the GB should be protected from potential future human encroachment.

Under 'sustainable utilization of species and ecosystems,' maintenance of the habitats of utilized species seems to be especially relevant to the management of the GB - as well as careful allocation and management of timber concessions. Pollard and McKechnie argue that Canada is nearing a critical point for forest policy (p. 22). The end of its old growth softwood timber is in sight, and pressure mounts on provincial and federal governments to invest heavily in intensive forest management (Ibid.). Which area provides a better show-case for new departures in forest management in general and the fostering of old growth forest in particular than the GB?

The section on priority national actions lists national (for example, the Forest Sector Strategy for Canada and the Federal Policy on Land Use, FPLU) and regional conservation strategies. It calls for adoption of anticipatory environmental policies and a cross-sectoral conservation policy, along with 13 other recommendations. Mention is made of the Interdepartmental Committee on Land, launched to oversee implementation of the FPLU - in an attempt to deal with the problem of fragmented political authority. Perhaps, the N.C.C. could take a cue from this example in coordinating future GB management strategies which integrate differing resource functions.

As far as conservation areas are concerned, the report advocates preparation of ecosystem evaluations based on the Canada Land Use Monitoring Programme and the contribution of the Committee on Ecological Land Classification. Again, the experience of these agencies might prove helpful for the N.C.C. in fleshing out details of a strategic plan. As the availability and cost effectiveness of Landsat data increase, such tools could be applied for a comprehensive ecological management approach to the NCR and beyond - possibly, an ecozone-specific reserve.

Among the remaining recommendations by Pollard and McKechnie, review and improvement of status, organization, funding and staffing of agencies with responsibility for living resources might be a boost to the N.C.C. Also, greater public participation in decisions concerning living resources and environmental education campaigns are endorsed - both these goals could be realized in future GB activities.

Implications for GB Strategies

In the section on Environmental Planning and rational use allocation, Munro et al call for ecosystem evaluation, namely a broad inventory of qualitative characteristics and use allocation compatible with that inventory. Demand allocation should pay attention to current as well as projected demand. Under "Comparisons of allocations and decisions on use," the authors propose the following conflict resolution mechanism:

> Reconcile conflicts by zoning and rescheduling; where this is not possible, decide use on the basis of environmental assessments, public comment and political judgment (Munro et al, 1980).

All along this process, public disclosure is mentioned. The citizenry has to be kept up to date on strategies of environmental planning, the WCS argues. Consequently, future GB strategies could evolve into a more open as well as a participatory process.

Conclusions

The focus of the original WCS remained exclusively on conservation - mutually reinforcing strategies on population, energy, food supply and economic development were not prepared. Due to this approach (which amounted to a missing link to implementing the strategy) it became difficult for readers of the document to integrate conservation into political and economic decision-making. The final chapter entitled 'Towards Sustainable Development' contained some suggestions for redressing inequities between rich and poor nations, but hardly any emphasis on communal grass-roots action.

Pollard's and McKechnie's report, much like the original WCS, tends to over-emphasize the role of government, neglecting the role of industry and consumers. Although the role of government-initiated research and development remains crucial (and deserves more funds), private enterprise has a role to play as well - recycling, for example, probably saves more trees than the practice of sustainable forestry. The second World Conservation Strategy addresses some of these concerns head-on.

World Conservation Strategy II, Draft (1989)

Underlying Principles

The second WCS (in draft form to date) attempts a more comprehensive approach. Albeit incomplete to date, it focuses more broadly on 'mutually reinforcing strategies' than the first. This emphasis on action makes the draft less of a purely 'allocative planning' document than its predecessor. Suggestions on mobilizing, financing and monitoring as well as evaluating the strategy are included in the first part. Part two lists priority actions and tools for s.d. - a substantive dose of innovative thinking.

Overall aims of the 1989 strategy are as follows:

a) Providing a broadly agreed description of what SD entails.
b) Identifying the main issues, priority actions, and essential tools to achieve SD.
c) Setting broadly agreed targets.
d) Providing a framework for mutually supportive efforts to meet these targets by communities, governments, and organizations at all levels (p. 1).

Munro et al. also attempt to move beyond traditional schemes to quantify benefits and costs of preserving wildlife. A section on 'ethics of SD' asserts that every life form is unique and warrants respect regardless of its worth to people (p. 3). Thus, these authors go beyond Brundtland in this regard. The N.C.C.

could use a dose of WCS II if the need for a philosophical justification of the conservation areas of the GB arose.

Canadian Responses

Prince Edward Island had been the first Canadian province to adopt and begin to implement a provincial conservation strategy - in April 1987. Only last month, the Conservation Council of Ontario released a discussion paper entitled An Environmental Strategy for Ontario: Draft For Public Review, which seems to follow up on points b-d mentioned above (Conservation Council, 1990).

The Ontario document proposes several strategies which could positively influence future GB management. The section on Wildlife and Habitat, for example, recommends establishing minimum standards and targets for the protection of natural areas within each of the province's 65 environmentally distinct districts. To enhance existing natural areas and rehabilitate degraded ecosystems, the draft suggests incorporating enhancement goals into regional and municipal Official Plans. This latter proposal, if implemented, would certainly benefit the integrity of GB natural areas in the coordination of future regional NCR policies and approaches to planning.

The provincial strategy also suggests charging an environmental cost for developing natural area lands and ensuring that user fees for natural areas and wildlife reflect their true management costs - to control the overdevelopment of natural ecosystems. Among recommendations for forestry, the following appear to be especially relevant to the GB:

Promotion of ecologically sound forest management by
1) incorporating forest values and other uses into the timber planning process;
2) promoting new pest control technology which is less hazardous to the health of the environment;
3) developing a value-added forest economy.

Addressing Ontario farmers, the Conservation Council proposes developing standards for sustainable agriculture, and an environmental "Code of Practice" for those involved in agricultural and food processing activities. Moreover, the economic viability of environmentally sound agriculture is to be ensured by incorporating environmental costs (i.e. pesticides, herbicides, etc.) into food prices. Some authors maintain that sustainable agriculture ultimately provides its own economic as well as environmental rewards (MacLeish, 1990; Reganold et al., 1990).

The Ontario strategy suggests reducing provincial energy consumption by 20 % by the year 2005. Among other means to achieve this goal, introducing efficiency standards for all consumer goods and developing an energy efficiency label for the same are mentioned. Especially the stipulation to incorporate an environmental cost into energy prices to subsidize alternatives could give a boost to the emergence of the GB as a generator of low-tech soft energy alternatives - if promoted properly by the N.C.C.

Finally, the Council promises to set up an environmentally sound waste management system for Ontario's municipal, commercial/industrial and hazardous wastes, by (among other means) establishing comprehensive provincial standards for waste management. Again, research within the GB could help formulate such standards.

On the whole, this new Environmental Strategy for Ontario seems more comprehensive, specific and practical than earlier vague general conservation principles. The question remains how diligently some of its provisions can or will be enforced and monitored. For example, what are the chances of enhancement goals for natural habitats being included in official municipal plans - now often dominated by pro-developer interests?

Issues Highlighted With Relevance to the GB

On sustainable rural development, WCS II elaborates thus:

"Implement programs with strong community direction and participation that increases the sustainable economic return from a diversity of wild resources, as well as from agriculture and timber production (p. 11)."

This statement could be interpreted to mean that rural communities, municipalities, and urban dwellers should be given a greater voice in the future management of the GB.

WCS II calls for the protection of 10% of every major habitat type in nature reserves by the year 2000 (p. 12). Adoption of sustainable agricultural farm practices is also advocated, specifically the minimisation of burning of crop residues and restrained use of nitrogenous fertilizers (p. 12).

Despite this more activist approach, Munro et al still place economics centre-stage. They do so innovatively, by introducing the concept of Total Economic Value (TEV). This term incorporates use value, option (future potential use) value, and existence value. Full-cost pricing is recommended for natural resources, consisting of extraction, environmental and user cost (incl. disposal). Produce grown in the GB could eventually be priced accordingly.

These suggestions are more concrete than the general reforms advocated by Brundtland. Although still short on specifics (how, for example, would future potential use be assessed?) this type of holistic cost-benefit analysis might well furnish a workable alternative to conventional environmental management. In the short run, chances are that conventional cost-benefit analysis might still be used as a basis for development and management decisions regarding the GB and its vicinity - for lack of a 'workable alternative,' but this should change soon. The WCS suggestion could provide a way out.

Implications for GB Strategies

Agricultural Sectors

Interestingly, WCS II asserts that an increase in global food production is not needed. Instead, governments are called upon to ensure that the best farmland is not lost for agriculture (p. 107). Small farmers, the authors maintain, ought to be involved in setting research priorities - but steps on how to achieve this remain to be worked out. The radical notion of 'empowerment,' however, remains. Consequently, the N.C.C. could lend a greater degree of autonomy to GB tenants when it comes to determining future courses of action.

Under the heading 'tools for actions' for sustainable agriculture, the authors make specific recommendations for redesigning agro-forestry and other measures (p. 109). They propose to condense the time span of vegetation succession and reconstitution through manipulation of species mixtures and to accelerate fallow regeneration by introduction of fast growing native shrubs and trees (Ibid.). Also, a redesigning of agro-forestry systems by incorporating ecological insights on tree architecture is suggested. Other recommendations with potential relevance to the GB include improving the nitrogen economy through nitrogen fixing plants such as legumes, using fast growing trees as windbreaks, incorporating cash crops, and introducing improved low level technology into farming (p. 110).

Forestry Sectors

In a similar vein, a forestry policy is suggested, which Munro calls a "three forest system." Farmed forest would provide timber as the chief product, modified forest would be a mixed production system, and the natural forest would basically represent a conservation reserve. The authors advocate a cross-sectoral forest policy to balance timber interests with those of other sectors in the economy (p. 117). For the management of the GB, GIS systems and 'environomic' analysis could be applied to facilitate such cross-sectoral approaches (Gelinas, 1987).

Conclusions

To summarize, though some conventional allocative thinking remains, a stronger component of innovation emerges in WCS II. This combination is especially salient in the following quote: "Governments should reduce fertilizer subsidies and eliminate pesticide subsidies, reallocating development efforts toward sustainable small farmer technologies (p. 109)." Munro et al. address predominantly the executive with their recommendations. Communal management is only fleetingly mentioned. Nonetheless, concern for social justice has increased.

The State of the World Report 1990
Underlying Principles

Since 1983, the State of the World Report series have provided yearly updates on environmental issues. Taking a global perspective, its authors record trends and impacts of new technological breakthroughs. Although Brown et al. have not come up with a concise definition of SD, they have sought to give it meaning by proposing indicators of sustainability which are less biased than the gross national product (GNP). The authors lament that the system of national accounting used to measure economic progress does not incorporate the depletion of natural capital (Brown, 1990, p. 3). The measures of sustainability suggested in the 1987 edition follow:

per capita gross world product
per capita fossil fuel consumption
ecological deflator for soil erosion
carrying capacity (Brown, 1987)

Obviously, problems of measurement could impair the reliability of such data for some time to come. But the ecological deflator for soil erosion could possibly be applied in the future management of GB agricultural areas. Soil erosion places Canadian farmland in jeopardy - as pointed out by Sparrow and others (Sparrow, 1984).

The 1990 edition of State of the World is more 'forward-looking than ever.' For example, the effects of global warming are sketched by its authors thus: "Besides temperature and precipitation, global warming will alter winds, humidity, and cloud cover - all influences on evapotranspiration and, thus, runoff (p. 51)." Drastic changes would raise the risk of flooding and could lead to scarcities in summer time (p. 52). As a consequence of global warming, additional irrigation will probably be needed to replace soil moisture in the NCR and the rest of Canada.

Canadian Responses

Environment Canada published the first State of the Environment Report for Canada in 1986. According to Tom McMillan, then Minister of Environment, that publication constituted the first assessment of that kind ever attempted in Canada. In magazine form, the department produced "Canada's Environment: An Overview," which summarizes salient points for the original publication in a more readable form.

Agricultural Sectors: Canadian farmland is diagnosed as being in a serious state. In the Mixed-Wood Plain ecozone (where the NCR is located), the report states that reductions in organic matter content of the soil of over 50 % have been found. Other negative factors in this ecozone which adversely affect farmland are erosion, land use changes (agricultural to urban and wetlands to agriculture), monoculture, fertilizer use, and pesticide use. While overall nutrient content has declined, new genetic varieties of crops demand more from

the soil, magnifying the problem. In response to such concerns, a nutrient content monitoring program in the GB could be initiated by the N.C.C.

Environment Canada finds cultivation practices wanting as well. Wide-row planting of single crops is criticized as leading to increased erosion from wind and run-off. Crop rotation is seen as a remedy. Also, loss of genetic stock figures prominently in the list of concerns: "The focus on a few commercial strains has led to the loss of many native varieties world-wide. We now depend upon a narrower genetic base that is more vulnerable to stress (Environment Canada, 1986)." The report advocates seed banks as a cure. The N.C.C., who already stresses native species in flower beds, can further promote native varieties of crops in agriculture as well.

Forestry Sectors: The report asserts that forest ecosystems are changing constantly. For example, almost all of the extensive white pine stands that used to blanket the Ottawa Valley have been lost. Such losses affect the natural balance of ecosystems: "As much as one half of Canadian forestland contains either immature or regenerating trees - far from the age structure expected in nature (p. 7)." Again, negative influences are identified. In the Mixed-Wood Plain, insects and diseases, conversion of forests to other uses and pollution are regarded as major problems. The final verdict states that Canada is running out of high-quality forest. In the GB, the N.C.C. has the opportunity to encourage the nurturing of old growth forest - it must be closely monitored, however, to prevent outbreak of fires and disease.

Conservation Areas: Finally, the report targets loss of habitat as the greatest stress on wildlife today. Next to increasing urbanization, transportation networks, growing energy demand and increasing recreational demand are highlighted as stresses on land - and wildlife. If there are new transportation corridors found necessary to run through the GB, perhaps they should be run underground. If this solution turns out to be too costly, overpasses or fences should minimize impacts of additional traffic on conservation areas. The rationale for existing roads should be re-evaluated, and where possible, expendable roads should be removed and the space concerned reclaimed for conservation.

T. J. Elkin elaborated thus on the potential of state of the environment reports (SOERs):

> There are no instances where an SOER has been prepared to identify issues and inform the public debate as a precursor to the preparation of a national conservation strategy (NCS). This must be considered a lost opportunity to provide the best possible forum for such a debate.... What is important is the interface between these two tools (Elkin, 1990).

Unfortunately, due to the vast complexity of natural systems, SOERs still tend to focus more on symptoms than causes. This makes them an insufficient, albeit a necessary, condition for implementation of an efficient conservation strategy and consequently, realization of an SD process.

Implications for GB Strategies

Agricultural Sectors

Since increases in world grain yields per hectare have levelled off during the 1980s, soil conservation methods become all the more important. Growth in the world's cultivated areas does not keep pace with population growth today, due to offsetting effects of pressures on the environment (p. 65). World per capita grainland in 1990 has declined to .14 hectares compared to .23 hectares in 1950. Brown et al argue that like any biological growth process in a finite environment, rises in grain yield will eventually conform to the S-shaped growth curve (p. 66). From this, the need to popularize soil conservation measures emerges. The N.C.C. can do so within the GB, ensuring proper runoff procedures and preventing soil salinization.

The State of the World Report sees new paths In the field of agriculture. For example, growing energy crops on marginal lands not currently used for food is suggested (p. 178). Trees thus grown could be periodically harvested and either burned directly or converted to ethanol. A renewable energy market would be opened up thus. However, the authors remain sceptical about biotechnology, in view of the fact that it has proved more difficult to apply to agriculture than anticipated (pp. 68-70). Energy crops could possibly be grown in some marginal areas of the GB.

Forestry Sectors

Finally, Brown et al talk of "extractive reserves" where people will harvest rubber, fruits, medicinal substances, and other non-timber forest products for domestic use or export - an alternative to the present slash and burn practices (p. 186). While primarily directed to the tropics, such recommendations could be acted on by establishing reserves tailored to temperate climates in the GB as part of a participatory SD initiative - for future food production to meet the needs of the NCR. Communal involvement requires guidance from existing political institutions - as Brown insisted in the 1989 edition. Notwithstanding this qualification, he also maintained that, although most development projects are funding-led, true development remains people-led (pp. 169-70, 1989 edition).

Commercial Sectors

Brown et al. predict that in "the sustainable economy of 2030, the principal source of materials for industry will be recycled goods (p. 183)." Photovoltaic cells they see as dominating the energy market forty years hence. Such devices could be mounted on buildings in commercial areas within the GB.

Conclusions

The State of the World philosophy regarding SD might be summed up as follows: The environmental predicament we find ourselves in is far too serious to be left to haphazard, piecemeal, and isolationist grass-roots approaches. A

coordinated effort is necessary. But SD also involves human dignity as an integral part of improving lives. Therefore, allocative and innovative elements have to be incorporated into any planning approach.

Unfortunately, Brown sometimes tends to neglect the political (rather than economic) processes which contribute to and serve to perpetuate unsustainability.

Development of a Conceptual Framework for Decision-Making With Regard to the N.C.C. Greenbelt

In the past, administration of the GB has suffered from a lack of direction. There were no clear policy guidelines, and as a result large areas were not properly maintained (Mathieson, 1973). The 1982 Management Plan came closest to a Mission Statement for the GB:

> "The Greenbelt's primary role is considered by the National Capital Commission to be the conservation of its natural environment, and the preservation and maintenance of its open, essentially rural character (N.C.C., 1982)."

This sentence addresses the what, but not the why of the GB. What is the 'raison d'etre?' In the face of pressures for development, this question is certainly relevant. I shall attempt to answer it with the aid of a conceptual framework for decision-making within the GB - drawing from the literature review and John Friedmann's classification of planning types.

First, a note of caution. The GB is government-administered and thus cannot serve as a vehicle for volatile anarchist forces. Conflict-style radical planning is obviously out of the question as a management option. The promotion, demonstration and implementation of SD strategies requires some degree of political guidance. Having said that, the three main types of planning (allocative, innovative, radical) all have a role to play in the dissemination of SD principles within the GB.

Allocative Planning. The localization of the food industry within the NCR seems to be in line with recommendations by Brundtland, Munro and Brown. A 3 to 4 % yearly increase in food production - maintaining sustainable agriculture practices - is a goal which could be aimed for the end of this millenium. In addition, the GB can continue to provide for the recreational needs of rural and urban people. More research and environmental education facilities should be established. Such facilities will be helpful in balancing demands for development with imperatives of conservation.

Innovative Planning. An integrative approach is needed to transcend the administrative fragmentation which presently hampers management efforts. Perhaps, a multilateral agency incorporating the municipal, provincial and federal levels of government is necessary to achieve this. More public involvement is required as well. Above all, encouragement of GB user group participation (particularly, for agriculture) in management should be increased.

The latter represents a step consistent with communal management advanced by the WCED and WCS II.

Radical Planning. The N.C.C. - or its successor - could use SD practices within the GB as a blueprint for social transformation. Priorities like reduction of CO_2 emissions, slowing global warming, practicing organic farming and sustainable yield forestry, promotion of soft energy options, and caps on commercial development based on the carrying capacity of natural habitats suggest themselves. A planning body which looks at environmental integrity before comfort and aesthetics is required. This agent could serve in an advisory capacity, possibly with veto power over important issues.

The following section will attempt to derive more specific 'links to action' from the conceptual framework outlined above.

Policy Implications and Specific Areas of Intervention for the Management of the Greenbelt

From the preceding discussion SD has emerged as a participatory concept - albeit guided by scientific and managerial principles. Management has to arrive at a compromise between the aspirations of rural people now residing within and near the GB and urban visitors' needs. In addition, the GB can serve as an educational device to demonstrate SD and as a manifestation of research and development's role in the evolution of land-related information and analysis. Research of global significance (for example, Third World solutions to the challenge of SD) could be carried out also.

The discussion paper "The Capital's Greenspace: Its Future Roles" contained some ideas which could help to direct the future roles of the GB - of special relevance are the following:

- Reflect and enhance the commitment and understanding of Canadians to environmental quality;
- serve as a catalyst for the participation of Canada's natural heritage and resources in the life of the nation;
- contribute to the quality of life in the Capital;
- set an example of relevance to other communities (Scott, 1989).

But theory is one concept, practice another. The N.C.C. should provide some realistic options on achieving greater economic and social sustainability over the next 20 to 50 years. The dictum "Think Globally, Act Locally" can be intimidating, but also empowering (Knox, 1990). Responsible behaviour can increase the individual's autonomy by means of long-term payoffs. To make GB activities economically and socially more sustainable - in terms of their contributions to the surrounding area - will require the cooperation of GB tenants, land managers, other agencies, and the general public. Consequently, a mutual (Friedmann would call it social) learning process has to take place.

The result will be processes of planning and management which promote sustainability, particularly because they rest on consensus.

If the N.C.C. wishes to realize certain broad SD principles within the next twenty to fifty years, GB tenants, N.C.C. land managers, other agencies and the public need to understand the rationale behind these principles - and the objectives derived from them. As we have seen, SD is a journey (albeit with signposts) rather than a destination - there cannot be a simple recipe for a final solution to this complex issue.

With this caveat in mind, there appears to be little to add to the previous N.C.C. report's summary of goals of SD (Billingsley, 1989). The goals are derived from the 1989 Tofino Steering Committee, the 1989 Northwest Territories discussion paper on SD, Reeve's 1988 position paper, and the World Conservation Strategy II. However, for the strategic management plan of the GB some elucidations on principles and strategies are in order.

Goals of SD

A) Bio-Physical System

1) **"to maintain essential ecological processes;"**
for the GB, this principle could be applied to those ecological processes to which the GB contributes regionally and which it depends upon from the outside. A GB strategy is needed which recognizes the part which all ecosystems play in the management of a sustainable society.

Examples: Watersheds, wildlife corridors, ravine corridors, forest reserves, major wetlands such as Stony Swamp and Mer Bleue, and regional ecological corridors such as Shirleys Bay/Stony Swamp and Mer Bleue to the SE.

2) **"to maintain biological diversity/resources at sustainable levels;"**
for the GB, this principle could be applied to conservation areas as well as agricultural sectors.

Examples: a) Crop rotation and multi-species forestry as well as habitat protection addressing the requirement to maintain minimum viable populations should be practiced.

b) Sustained yield management has to be practiced in agriculture and forestry. To ensure compliance, water tables could be monitored to ensure that withdrawals for commercial purposes do not impede the capacity of the hydrological cycle.

B) Socio-Cultural System

1) **"to increase people's control over their lives;"**
Consequently, the joint management of the GB could become a vehicle of empowerment for the local citizenry. Greater involvement in management would result in greater support for the GB concept and the GB area as a place locals can identify with. To achieve that goal, residents have to realize the purpose of SD (e.g., GB not 'impediment' to development), be aware of strategic plans, take responsibility for strategies to implement them, and take action to further the cause of SD in their daily lives.

Examples: a) NCR governments, residents, and GB tenants have to become more involved in less bureaucratized and more cooperative management decisions. Perhaps, this principle could be realized by a Round Table approach. This will serve to increase people's awareness of SD, and thus help to further consolidate the concept.

b) In open space areas of the GB, demonstrations could take place which make people aware of the power they have to promote SD (e.g., composting, separating garbage, producing less waste, conserving energy, etc.). Some of these demonstrations could be done by the private sector - recycling firms, energy-efficient manufacturing companies, etc.

2) **"to maintain and strengthen community identity;"**
This principle could be realized by presenting the GB as shaping the identity of the NCR along with traditional symbols like the Peace Tower. The NCR could be redefined as an 'ecozone community.' The Mixed-Wood Plain ecozone presents certain opportunities as well as constraints for SD which differ from other ecozones.

Examples: a) Urban structure role - the GB has encouraged distinct communities outside the GB; Orleans, Barrhaven and Kanata. It could have a continuing role in the future to promote more self-sustaining communities as they grow.

b) Environmental awareness programs should be extended. Locals as well as tourists could thus become more educated about indigenous plant and animal species - an 'ecological home' ethic could be fostered.

c) The GB concept could be more vigorously promoted as an example for other urban areas within Canada and beyond. Ecosystem planning could well become synonymous with economic planning in the near future. Natural areas surrounding urban centres can serve as storehouses for CO_2 and provide a variety of recreational opportunities.

3) **"to be compatible with the culture and values of the people affected;"**
SD has to be phased in in a gradual, non-threatening manner. In the Canadian context, pragmatic solutions resting on public consensus have

traditionally worked best. The GB thus serves as reminder that ecosystems constitute as much a part of local cultures as man-made landmarks. The realization of the goals of SD requires public understanding and acceptance of environmental concerns as a basis for decisions.

Examples: a) Ottawa Valley history could be taught in the GB in terms of resource bases (i.e., forests for logging) and the problems resulting from unsustainable harvests of those resources. The GB can be presented as original landscape before human settlement and thus a living reminder of history before civilization. Originally, the NCR was mostly a wetland area.

b) In farming, sustainable agriculture has to be profitable as well as environmentally sound. The responsible, cost-conscious farmer is not interested in wasteful (i.e., excessive pesticide and fertilizer use) cultivation practices and therefore demonstrates very well the practicality of linking environment and economics in strategic planning. More 'demonstration farms' could put this message across to city dwellers.

C) Economic System

1) **"to promote economic efficiency;"**
The GB could become a bread basket for the NCR, possibly beyond, promoting sustainable ways of making a living.

Possible strategies for the GB:
a) Recycling and soft energy firms could be established in the GB public areas of little natural significance in order to promote new economic competitiveness.

b) Among the types of farming currently practiced, at least one representative of the organic school should be added. Thus, more knowledge could be gained about the long-term profitability of pesticide/fertilizer use vs. no chemical substance use.

2) **"to be equitable within and between generations and to stabilize the local economy;"**
For the GB, this objective could be framed in the following terms:

a) demonstrate sustainable production as well as consumption patterns;
b) communicate the concept of intra-generational equity;

Examples: a) Where possible, low-input sustainable agriculture should be practiced. The N.C.C. should have at least one practicioner of organic methods in each branch of agriculture.

b) Implement interpretive programs designed to drive home the value of wetlands and conservation areas in general to future generations (i.e., power-house for renewable resources). Also, nature should be presented

as valuable in itself, regardless of potential as renewable or non-renewable resource.

3) **"to be financially self-sufficient;"**
NCR self-sufficiency in produce within 20 years could be aimed for. This objective would help to popularize SD as an economically viable concept that can pay its way - if given some time. SD in the GB would thus reduce the NCR's dependence on other regions for resources. Other regions could take a cue from this goal. Self-sufficiency also means less waste of energy (i.e., transportation, storage, etc.).
General management of the GB should be executed on a basis of financial self-sufficiency - as a 'working' landscape and as a demonstration that economic, social and environmental factors can operate in harmony with one another.

Examples: a) In areas of less natural significance, environmentally friendly technologies can be fostered to diversify the NCR economy beyond public service and hi-tech industry. Low-tech options include solar energy, wind power, etc. The concept of appropriate technology needs to be popularized. Fruits of research can then be displayed, promoted and sold to people residing in appropriate ecozones across the country.

b) In the long run, the goal could be providing for the needs of the whole NCR and vicinity. Rather than growth-based, the economy of the future will focus on efficiency (i.e., less energy intensive) and more equitability in its impacts.

c) Action-oriented environmental education programs could be promoted in order to pay for themselves (for example, as a tourist attraction).

Complementing these general roles, the following sectoral breakdown further elaborates on the role of SD principles and strategies in the future management of the GB.

SD Strategies by GB Sector

1) Agriculture: Western, Southern and Eastern Farm Sector (in particular)

Principles: 1) Provide information on and incentives for sustainable farming practices;
2) Apply an agro-ecosystem approach;
3) Practice sustainable harvesting of fertile soils, (especially cultivating methods);
4) Increase diversity of crops;
5) Minimize use of chemicals - practice integrated pest management within the GB (IPM);
6) Increase production for local needs - aim for self-sufficiency in produce for the NCR;
7) Consult farmers about these objectives and their individual feasibility.

Strategies

Sustainable agriculture has been defined as "agri-food systems that are economically viable and meet society's need for safe and nutritious food, while conserving or enhancing natural resources and the quality of the environment for future generations (Leblond, 1990)." Healthy soil remains basic to the long-term viability of agriculture. Through national and international networking, the N.C.C. administration and farmers in the GB can maximize the potential for successful long-term sustainable agriculture.

The agro-ecosystem approach entails the use of holistic management and production strategies which are tailored to the specific ecological characteristics of each (eco-)zone (Leblond, 1990). Its essence is to maintain as far as possible the same types of interspecies relationships, nutrient cycling and biodiversity which characterized the natural ecosystem, while respecting the natural carrying capacity of the land. The approach does not explicitly require organic cultivation practices, but implies 'sustainable' chemical use, crop production and animal husbandry practices.

Consequently, only those agricultural uses compatible with the GB wetlands' ecological functions should be permitted (Munro, 1989). Crop yields could be compared between areas not using artificial fertilizers and those that do. New composting techniques could increase fertility of soils. For example, Agriculture Canada has developed such a technology for fish wastes. Biological pest control could protect crops and thus ultimately increase yields and profitability of agriculture.

Where possible, Canadian equivalent of the US low input sustainable agriculture program (LISA) could be implemented within the Greenbelt. Part of this would be a more efficient irrigation system, dubbed LEPA - low-energy precision application (Brown, 1990). Ultimately, the practice of sustainable agriculture should yield enough produce to meet the needs of areas surrounded by the GB. Plants which are more salt-tolerant, drought-resistant,

and water-efficient could play a vital part in securing adequate food supplies for the NCR region 20 to 50 years hence.

Generally speaking, greater encouragement of crop rotation and promotion of organic produce should be provided. An economic rationale for crop rotation has been furnished by Reganold. He argues that where crops are rotated, the yields are usually from 10 to 15 % higher than when they grow in monoculture (Reganold et al., 1990). Rotating supplies better weed and insect control, less disease buildup, more efficient nutrient cycling, and other benefits (Ibid.). To be sure, crop-soil compatibility has to be kept in mind. Finally, a biologically diverse farming system remains less susceptible to the economic woes of a flooded market or a fall in prices for a single crop.

The elimination of grading practices which define top quality according to appearance has been suggested by an environmental group (Greenprint for Canada Committee, 1989). This policy tends to discriminate against organic produce - which does not look as 'shiny' as the products of more artificial methods. A change of regulations could serve to increase public health in the long run, in addition to encouraging organic farming practices. The N.C.C. can provide catalysts for such change.

However, some of the strategies suggested by Brown, Brundtland and Munro may not be economically viable in the GB because of soil limitations. Very few Class I agricultural areas are to be found there - most areas fall within the Class II to IV range. Therefore, LISA might not always be a realistic option. Nevertheless, farm policy should aim at minimisation of pesticide and fertilizer use (to protect watersheds) and minimize runoff into the Rideau River and other watercourses. Wide-row cultivation should also be avoided because of its tendency to increase risk of soil erosion.

This demonstration of a localized sustainable economy would conserve energy (and reduce CO2 emissions) by providing a more compact network for food distribution. Moreover, it would show more sensitivity to specialized consumer needs (Lovins, 1977). Self-sufficiency in produce of the NCR should be the goal, possibly within the next 10-20 years.

Brown et al suggested that the use of treated urban wastewater for irrigation is likely to become commonplace. This practice returns valuable nutrients to the land, where they belong, and helps keep them out of rivers and streams, where they become troublesome pollutants (Brown, 1990). Excess sludge could be used as an animal food supplement.

Farmers' needs have to be considered in the layout of future transportation corridors (if they are deemed to be necessary). An N.C.C. researcher lamented that "many farms are no longer viable units because of insensitive transportation planning (Mathieson, 1973)." To increase commitment to the agro-ecosystem approach, tenure arrangements might have to be strengthened in some cases. Farmers in the GB should be kept up-to-date on

the latest developments in the field of sustainable agriculture and be given every opportunity to test new technologies.

Above all, agriculture should come to be seen as a permanent (rather than merely a state-subsidized, profit-maximizing) enterprise - by both farmers and stakeholders. Practicians of organic farming should be encouraged to settle in the GB - their produce should be promoted as environmentally friendly. To minimize the potential for conflict in carrying out such objectives, representatives of GB farmers' interests should be consulted on a continuous basis about the evolution of N.C.C. policy. Channels of communication have to be kept open to ensure success of SD principles in the GB farming sectors.

2) Conservation Areas: Stony Swamp and Mer Bleue

Principles: 1) Demonstrate ecosystem (specifically: wetland) value for present and future generations;
2) increase public awareness of ecosystem sensitivity and vulnerability (for example, min. viable populations concept);
3) show fallacy of trying to separate natural from 'man-made' environments (i.e., cities as ecosystems);
4) control public access;
5) monitor ecosystem integrity.

Strategies

Wetlands have been referred to as nature's kidney's (Keating, 1988). They perform a variety of cleansing functions. For example, inland wetlands provide groundwater replenishment and flow regulation, sediment control, filtration of pollutants, wildlife habitat, microclimate modification, and educational value (Lang and Armour, 1980). These advantages should be widely displayed in the GB and publicized by the N.C.C. as a rationale for future preservation of GB wetlands and bogs. Also, the National Wetlands Working Group has estimated that wetlands contribute at least $ 5 billion annually to the Canadian economy (Keating, 1988).

The municipality could maintain, expand and provide linkages between existing City parks to relieve the pressure on the GB. Those parks demonstrate how wildlife exists and survives amidst urban congestion and therefore heighten public awareness of ecosystem viability and vulnerability. The conservation areas of the GB could be promoted as the lungs of the NCR - to indicate that their integrity remains vital to the well-being of residents. Non-consumptive use should continue to be emphasized. The development of environmental sensitivity seems to be directly related to experiences in outdoor settings (Ramsey and Hungerford, 1989). Ecozone-specific environmental management should be stressed. Activities which are sustainable in one ecozone need not necessarily be sustainable in another. For example, Canada's arctic regions are far more sensitive than other regions.

Canadians engage in a wide variety of outdoor activities. Polls show that a majority value wildlife for its own sake (Filon, 1989). As the demand for outdoor

recreation increases and the supply of natural areas diminishes, options have to be evaluated to limit the number of visitors to environmentally sensitive areas - in the interest of ecological integrity. Tourism Canada played a leading role in the drafting of an Action Strategy for Sustainable Tourism Development. The N.C.C. could incorporate some of the strategy's recommendations in Conservation, Forestry as well as Recreation Sectors of the GB. For example, fees for admission to prime natural habitats like Stony Swamp and Mer Bleue might be levied so as to provide control of access as well as to indicate the value of prime natural areas.

Roads pose a challenge for sustainability in conservation and other areas through their effects of habitat fragmentation, noise, and other impacts. Studies indicating the overall function of the GB and adjacent areas now and in the future should provide the guidance necessary to determine the acceptability of roads in certain areas of the GB (see also chart in forestry section). Bike paths, hiking and cross-country trails could be designed so that accessibility remains at a 'sustainable' maximum. The use of private motorized vehicles within conservation areas should be prohibited where possible - to minimize CO_2 emissions within the GB and protect natural areas from residues.

The water table needs to be monitored to ensure the long-term survival of crucial wetlands like Stony Swamp - withdrawals for agricultural and other purposes must not exceed the hydrological capacity of the GB. A Water budget could be established. The potential for eurotrophication (due to fertilizer use), acidification and drainage of wetlands should be minimized or eliminated, if possible. The surviving portions of Stony Swamp which remain in private hands could either be purchased by the N.C.C. or be designated for protection in municipal zoning as Class I wetland under the provincial wetland evaluation method (Hamill, 1988). Obviously, an integrated GB management approach is required to achieve this goal, transcending administrative fragmentation.

The effects of decibel levels from airport activity on natural systems have been investigated before, but need to be monitored on an continuous basis. Possible genetic effects cannot be ruled out. Also, the concept of minimum viable populations (MVPs) within ecosystems requires further exploration. In co-operation with federal departments and the private sector, such research could be carried out within the Greenbelt as an 'open process' wherein the public would be kept informed about developments.

Potential effects of ozone on habitats should also be monitored. In a larger context, compilation of the conservation areas' physical assets could be utilized towards establishment of an inventory of 'productive assets (Repetto, 1989).' Such an inventory would be a first step in the path to include resource bases as fundamental components of the Gross Domestic Product (GDP) - as suggested by Brundtland, Munro and Repetto, among others.

3) Forest Reserves: especially, Pinhey Forest Reserve and Pine Grove Sector

Principles:
1) Demonstrate benefits of vegetation (esp. forests) to humans in an urban environment;
2) Foster an appreciation of forests as valuable ecosystems rather than as a renewable resource;
3) Maximize biological diversity in stocks;
4) Protect old growth forest;
5) Maintain tree and brush cover for small mammals and birds to retain optimum viable populations in forest stands;
6) Minimize the use of herbicides and fungicides in forest tending practices;
7) Involve the general public in forest management.

Strategies

A list of urban vegetation's direct and indirect benefits to humans has been provided by Lang and Armour:

1) air conditioning;
2) microclimate modification;
3) water retention;
4) erosion control;
5) habitat;
6) noise attenuation;
7) visual barriers and screening;
8) aesthetic and other social benefits.

Again, these benefits should be widely displayed within the GB and publicized within the NCR. The multiple functions forests perform have to be communicated in order to counteract simplistic notions of forests as convenient resources to be exploited at will. To be sure, economic benefits can be reaped from timber and other species - but only if cuts are done selectively, with the ecosystem's capacity for regeneration in mind. Requirements of animals residing within forest habitats also have to be considered more extensively. For instance, crucial migration corridors must not be allowed to become disrupted as a result of harvesting (or construction) procedures. Consequently, an integrated management approach with municipalities should be strived for - as is now the case with the implementation of a Geographical Information System (GIS) involving the region.

The diversity of the forest ecosystem has to be maintained in order to maximize natural resistance against pests. For regeneration of stocks, selective cutting might be necessary in some cases to mimic naturally occurring forest fires (Sargeant, 1990). This should be done with small animals (which depend on forest cover) in mind. Many species require dense tree and brush cover for their survival, well-being and procreation. While natural forests might look 'unkempt' to the human eye, they fulfil crucial functions within the biosphere. To be sure, firebreaks (i.e., clear areas) should be retained between forest lands and residential areas. Future zoning legislation should incorporate the need to

maintain the viability of existing forest stands. Again, this goal could be achieved through an integrated strategy involving municipalities.

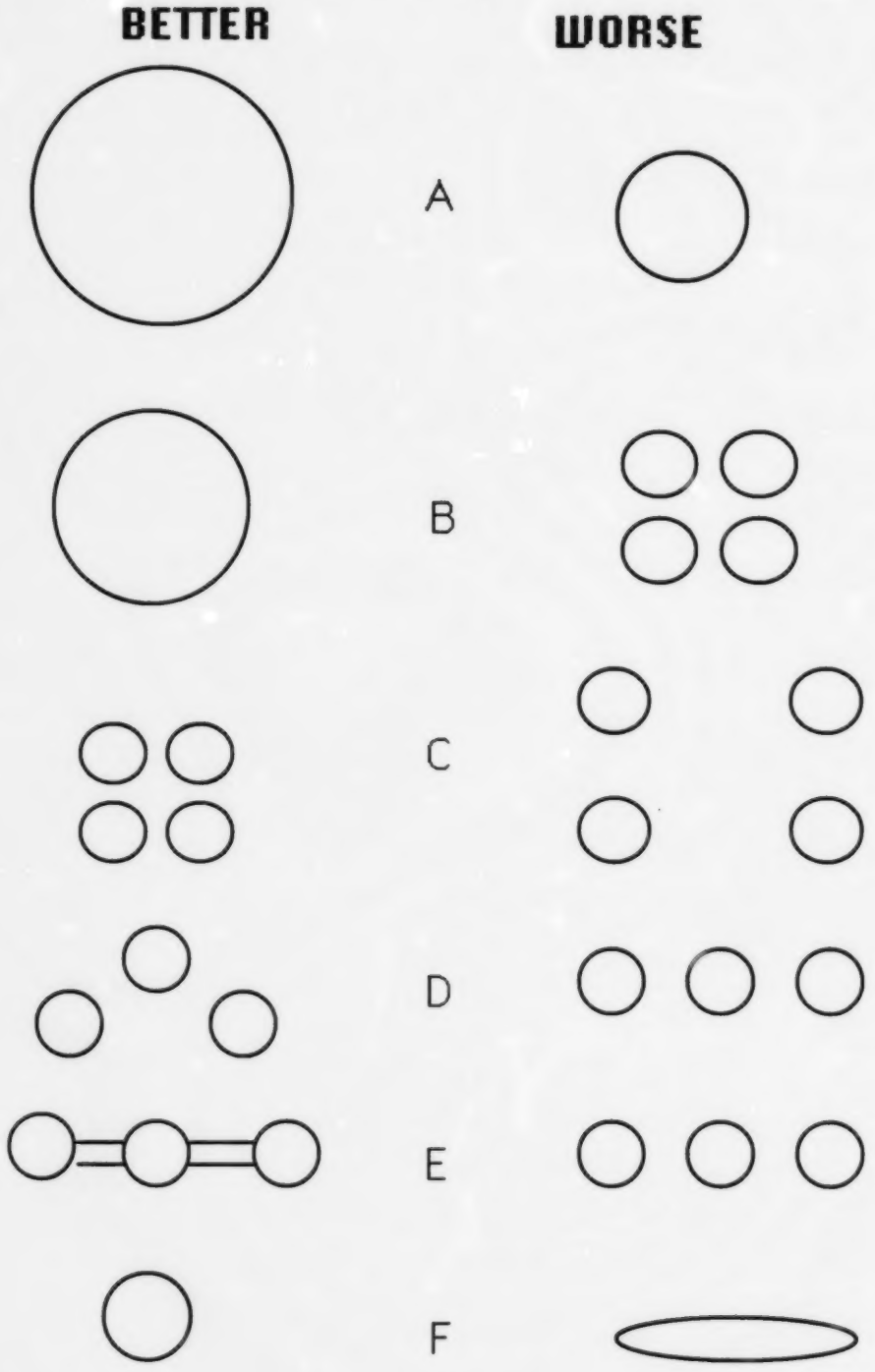
The WCS I suggested geometric principles for the design of nature reserves, derived from island biogeographic studies. The graph which summarizes these principles merits reproduction; see following page. In each of the six cases labelled A to F, species extinction rates will be lower for the reserve design on the left (Munro et al., 1980). Consequently, the N.C.C. can apply these principles in future decisions regarding the selling off or acquisition of natural areas. Again, migration corridors have to be kept in mind.

Sustainable forestry depends on soil, ecological diversity and genetic diversity. Therefore, old growth forests (OGFs) have to be especially guarded and monitored. High organic matter content in soil depends on OGFs. Important OGFs should remain inaccessible to the general public, to minimize risks of human-induced forest fires. Effects of acid precipitation on forest lands within the NCR should be analyzed continuously. Species dependent on OGFs should become designated indicator species.

Current N.C.C. forest tending practices might require some re-thinking to ensure long-term viability of GB forest ecosystems. For example, spacing between tree plantations, whether domestic or exotic, could be less linear to strengthen their natural resilience. Chemical tending should be minimized. The term 'improvement cuts' should be narrowly defined. Ecosystem integrity ought to come first, aesthetic considerations second. When necessary, logging should preferably be carried out by girdling rather than chainsaw - to reduce noise and other pollution in forest areas. Reforestation of areas not designated for other purposes could be stepped up to maximize the viability of existing forests and to minimize drainage problems in the GB. Wherever feasible, regeneration should be allowed to take place by natural means.

Generally speaking, forestry operations should be kept as de-bureaucratized as possible, and 'naturalized' as far as possible. For example, the present N.C.C. management objective in the 1982 GB Management Plan for "financial returns on forest land and management investments" might have to be changed to ecological returns (N.C.C., 1982). Is it meaningful to speak of 'representative native forest lands?' In order to meet that criterion, forest size as well as tree species diversity might need to play a role. Again, less emphasis should be laid on aesthetics in classifying trees - i.e. "healthy but of less desirable form (Leger, 1984/5)."

The general public's identification with and concern for GB forests can be heightened by environmental education as well as increased involvement in their management. Assuming greater responsibility for ecosystem integrity, citizens' groups could eventually launch a neighbourhood watch program against vandalism (i.e., tree theft, littering, etc.). People within and outside the NCR can participate in tree planting and forest maintenance programs. Tree adoption programs could be launched to decrease the sense of separation from the natural environment felt by many city dwellers today.



Source: World Conservation Strategy, 1980

4) Recreation / Commercial: especially, Bruce Pit Sector and Shirleys Bay

Principles:
1) Teach environmentally responsible behaviour;
2) Demonstrate compatibility of SD with culture and values of people;
3) Show that SD is a realistic alternative to present energy-intensive ways and makes for good business;
4) Demonstrate how SD can increase people's control over their lives;
5) Popularize SD as an example for other ecozones across Canada.

Strategies

Environmental education programs within the GB should be action-oriented to promote responsible environmental behaviour - for children as well as adults (Ramsey and Hungerford, 1989). They could be partially implemented by the private sector on a profit-maximizing basis. More stress could be laid on interpretive centres. These centres could put the message across how past economic practices and customs did long-term damage to the environment. Practical alternatives could be presented - i.e., how different approaches could have contributed to safeguard the environment, leaving the cultural make-up of society intact. Approaches to planning which recognize the closed circle of ecosystem processes should be suggested - and asked for in interactive displays.

Cycling, hiking, riding, and cross-country skiing within the GB should be encouraged, since these activities serve to lower Canada's excessive per capita energy consumption. In critical areas, where access needs to be monitored, fees could be levied. On the other hand, use of dirt bikes and skidoos should remain prohibited - noise and other pollution generated by these vehicles disrupt wildlife. Moreover, they use too much energy. More Golf courses as well appear to be incompatible with the dictum 'equitable sharing of natural resources.' Dedicating large amounts of greenspace for the exclusive use of humans in prime natural areas does not appear to be a 'sustainable' management decision. But there might be less critical habitats available for such purposes within the GB.

17 years ago, an N.C.C. researcher elaborated thus on the problem of making natural areas economically viable:

> "... economics is unable to provide a way of establishing a clear net benefit one way or the other. There are too many intangibles involved, which cannot be standardized for economic analysis (Mathieson, 1973)."

Given that constraint, perhaps a deliberate push for SD could be waged by the N.C.C. in order to create a market for environmentally friendly products within the NCR. In the GB, recycling firms, for example, could be allowed to establish themselves in buildings now vacant. Their activities in detail could then be made known to the public. The present federal nodes' economies could be more oriented towards the GB. Environmentally friendly products, research on

soft energy options (Lovins, 1977), and tourism-focussed environmental education programs are just three of many possible options. Obviously, such a change of course should be carried out in cooperation with municipalities. Initially, incentives in the form of tax breaks could be provided to get activities off the ground which make economies more sustainable.

Suggestions on how people can make contributions to sustainable development in their own lives should be highlighted in the GB. School boards could play a more direct role in the administering of environmental education programs. The individual has to become more conscious of his/her responsibility and power to participate in the making of a sustainable society. Recycling, growing one's own produce, and composting could be used as examples how people can increase control over their lives by making their households more 'sustainable' (i.e., less dependent on major distributors for supplies and less wasteful). The City of Ottawa has already published a pamphlet on composting techniques for households. A coordinated approach with municipalities could thus be initiated. Monetary savings (for individuals, households, and communities) could also be calculated over a period of time.

Within the larger context of the NCR, the creation of planned, environmentally enlightened communities should be aimed for (Simonds, 1978). Photovoltaics, wind power, and hydro power on a small scale come to mind as alternatives to energy overkill - A. B. Lovins called these alternatives "soft energy paths." Energy through waste could also become an option. Needs of Canada's other ecozones should be considered. The traditional centre-periphery growth paradigm should be jettisoned in favour of greater local autonomy. In practice, this could mean adoption of areas in the GB by citizens - for example, forest plantings.

The present federal nodes could also be further utilized as science parks to supply more detailed knowledge towards the consolidation of SD as a coherent, realistic concept. The "environmental industries" initiative of Industry, Science and Technology - designed to promote the development and application of Canadian environmental technology - could thus be given a boost. Reduction of energy consumption could be one of the goals of scientific inquiry. Establishment of international standards and measuring methods in environmental matters could be another. The N.C.C. can play a supportive role in initiating such activities in the NCR and the GB.

5. Conclusion

SD will probably never be a rigorous, deterministic concept. We have only begun to appreciate the complexity of natural processes. Moreover, what is sustainable for one location and one people may not be sustainable for another - different ecozones call for different approaches. Consequently, we need flexibility and open-mindedness regarding the potentials of SD. Robinson et al. have defined sustainability as a 'normative ethical principle:'

- It has both necessary and desirable characteristics. There therefore exists no single version of a sustainable system.

- Both environmental/ecological and social/political sustainability are required for a sustainable society.
- We cannot, and don't want to, guarantee persistence of any particular system in perpetuity. We want to preserve the capacity for the system to change. Thus sustainability is.. only approached. It is a process, not a state. It will often be easier to identify unsustainability than sustainability (Robinson, 1990).

In the conventional sense, land use determinants for strategic management are population and economic growth, private market forces, land use regulation, public services and facilities, and natural features and constraints (Lang and Armour, 1980). All these constraints will continue to impact upon and interact with the process of implementing SD principles in the N.C.C. Greenbelt. But the ecological perspective should not become submerged as a result. Planning today is about to incorporate portions of that perspective.

Environmental Planning has been described as the development of strategic means for ensuring the best possible living conditions for all forms of life. (Simonds, 1978) Such planning - synonymous with SD principles - should assist in making the GB an ecologically, culturally, and economically viable area. In its broadest form, SD can be said to promote harmony among human beings and harmony between human beings and nature. The N.C.C. thus has a unique opportunity to demonstrate harmony with the environment - rather than its enslavement and ultimate degradation by unsustainable economic practices.

Published in June of this year, the Report of the Interdepartmental Workshop on SD in Federal Natural Resource Departments concluded thus:

> The successful promotion of SD will require a comprehensive effort. Examples of measures which will be needed are a greater commitment to environmental science and research, analysis and implementation of the use of policy and economic instruments to achieve environmental objectives, environmental review of government policies and programmes, government staff training and support, a system of incentives and rewards for programme managers, clear lines of accountability, the communication of SD success stories and the building of partnerships with stakeholders (Bregha and Bond, 1990).

Consequently, the N.C.C. could promote research and increase the sense of community and partnership between stakeholders in and around the GB, even beyond the NCR. Realization of the principles of SD without substantive changes in strategic planning and management approaches will remain elusive.

For example, the new, more stringent FEARO guidelines give the Minister of the Environment greater powers to implement SD principles (FEARO, 1990). But SD (like morality) cannot be legislated. In order to ensure the long-term viability of SD, changes within society need to go deeper. Greater sensitivity to ecological processes cannot be coerced. Environmental education remains the key - and the N.C.C. is holding it with the Greenbelt.

APPENDIX I:

USEFUL CONTACTS IN THE QUEST TO IMPLEMENT SD STRATEGIES

1) Bio-Dynamics, 8 Cheval Court, Richmond Hill, Ont., L4E 1H5
   - society for bio-dynamic farming and gardening in Ontario

2) Canadian Organic Growers, 33 Kamwood Dr., Scarborough, Ont. M1L 2Z4

3) Cross Cultural Learner Centre, 533 Clarence St., London, Ont. N6A 3N1
   - promotes cross-cultural awareness (432-1133: Gillian Phillips)

4) Federation of Ontario Naturalists, 355 Lesmill Rd., Don Mills, Ont. M3B 2W8
   - specialists in wetlands conservation

5) Guelph Environmental Council, 5 Douglas St., Guelph, Ont. N1H 2S8
   - involved in waste management and recycling

6) The London Co-op Store, 621 Princess Ave., London, Ont. N5W 3L9
   - sells organic food (679-0570)

7) Luz International (California), the world's foremost solar energy producer.
   Manager: Jim Bazor.

8) National Center for Appropriate Technology, Box 3838, Butte, Mont. 59701
   (406) 494-4572; publishes publications on appropriate technology
   "Compost Toilets - A Guide for Owner-builders," etc.

9) Rocky Mountain Institute (Colorado); non-profit organization for energy efficiency.
   Amory Lovins, author of Soft Energy Paths, overseas research programs.
   Publication: **Competitek,** report on new cooling and heating devices, lights, motors, and other modest efficiency products and systems.

APPENDIX II:

LIMITATIONS OF THE 1982 GREENBELT MANAGEMENT PLAN

Agriculture

The GB Management Plan contains the following priority objectives for agricultural sectors:

> 1) to protect, develop and improve the farmland resources through proper and management and improvement practices, and through the establishment and maintenance of privately operated, efficient, and modern farm enterprises;
>
> 2) to provide an effective operating environment for farming in the interests of maintaining a vital and appealing rural agricultural landscape, protecting N.C.C. investments in buildings and land improvements, and supporting good farmland management practices.

Beyond farm viability, the plan does not elaborate on what the N.C.C. considers to be good farmland practices. Thus, it falls short of providing any substantive recommendations.

Canada's National Agriculture Strategy, developed jointly by the federal and provincial governments, goes a little further in this regard:

> 1) To develop and promote agricultural soil and water-use systems that ensure conservation of the soil in the long term, take advantage of development opportunities and are in balance with domestic and world market opportunities.
> 2) To ensure that the long-term economic viability of rural areas is maintained through proper use of the soil and water resource base.
> 3) To reduce and control the effects of farm activities on other areas, so that agriculture does not negatively affect other resource users.
> 4) To make the public more aware of soil, water and environmental issues through educational and awareness programs (Environment Canada, 1987).

These principles were derived from the WCED's report.

Conservation Areas

To quote again from the Management Plan, priority objectives are:

> 1) to protect, develop and improve the natural and historic resources through maintenance of an environment in which viable ecosystems can function normally, and through proper resource management and protection practices.
>
> 2) to consolidate areas within clearly defined boundaries while providing a broad ecological base for the formulation of a comprehensive development plan for the sector as an identifiable 'conservation area.'

Points three and four refer to promoting environmental awareness and to providing opportunities for recreational activities. Unfortunately, the objectives do not elaborate on what 'proper resource management' practices might entail.

Ambiguity and confusion tend to take over when 'mission statements' lack specifics.

Forestry

Priority objectives of the Management Plan:

1) to develop and improve the natural resources in order to establish stable and compatible land use patterns, dominated by a unique forestry operation, which provides
a. a long-term basis for woodland recreation,
b. a wide range of interpretation opportunities,
c. a possible source of revenues, and
d. wildlife habitat.

Points two and three refer to interpretive programmes and various recreational pursuits respectively. These priorities fail to address the problem of monoculture in forestry as a potential source of unsustainable forestry practices (Sargeant, 1990). Diversity of tree species appears to increase resistance to pests. Nonetheless, most recommendations in the 1982 Management Plan as they pertain to forestry are sound.

Sustained yield forestry has been aimed for for years by departments like Environment Canada. Yet, practice has fallen short of policy statements. The Science Council of Canada pointed out that during the early 1980s, only about a quarter of the cut-over area in Canada was replanted or seeded (in Fox, 1988).

Mixed Use Sectors

On mixed use sectors, the Management Plan comments with regard to priority objectives thus:

1) to develop and improve valuable natural and historic resources, creating a unique type of urban open space which provides key future linkages between the open space systems of the Capital and its peripheral communities, and meets the open space needs of a wide range of cultural and recreational activities;
2) to maintain a people-oriented character, with land uses emphasizing the usability of the open space's surrounding structures, opening up the area to a greater range of people, and providing a more imaginative and visible demonstration of good resource management.

These objectives do not purport to involve visitors in SD activities - for the most part, passive teaching is stressed. Moreover, the proposition of making the GB economically viable only surfaces under the 'non-farm residential' section as management objectives. To be sure, problems from a purely cost-benefit perspective remain.

APPENDIX III:

THE ROLE OF LAND USE PLANNING IN CANADA

The history of land use planning in Canada dates back to the depression. The Prairie Farm Rehabilitation Act (PFRA) of 1935 sought to improve the lot of draught-stricken farmers. It was followed by the Agricultural Rehabilitation and Development Act (ARDA) of 1961. Nigel Richardson of the Canadian Environmental Advisory Council maintained that both acts could be "regarded as precursors of sustainable development, inasmuch as they combined economic development and conservation objectives (Richardson, 1989)."

Yet, regional development remained largely the preserve of economists - manifested in the creation of the Department of Regional Economic Expansion (DREE) and its successor, the Department of Regional Industrial Expansion (DRIE). Moreover, Richardson stresses that land use planning was largely considered to be an area of provincial jurisdiction - traditionally the level of government more susceptible to property interests.

Although conservation strategies by the federal and provincial governments are now being prepared, the smallest province in Canada has a headstart in their implementation. Prince Edward Island's Conservation Strategy includes recommendations on agriculture, forestry, and protection of special areas.

In 'Land Use Planning and Sustainable Development in Canada,' Richardson summed up the contributions of land use planning to sustainable development thus:

1. Promoting efficient use of land by regulating wasteful or unnecessarily costly forms of development and by encouraging multiple use of land where different uses can coexist harmoniously.
2. Allocating renewable resources, esp. forest resources and water, for optimum and sustained use.
3. Protecting lands, resources and features of special value from destruction or misuse.
4. Resolving competing demands for land in relation to predetermined goals, criteria and priorities.
5. Encouraging and facilitating environmentally sound economic development.
6. Reducing environmental pollution through controls on location, siting and design... of development.
7. Promoting sustainable urban development through the regulation of form and density... (p. 38)

He sees land use planning not as a panacea, but as a 'tool of considerable potential value and versatility (p. 38).' That author identifies fragmentation of authority and perception of land primarily as a private asset as major drawbacks to its effectiveness. The federal government, he argues, has an indispensable role as a source of land-related information.

Perhaps, the N.C.C. Greenbelt could serve as a tangible manifestation of that role. Richardson called for the recognition of land as integral to the life support

system of the human species - so that we think of it in terms of stewardship rather than of exploitation (p. 47). But the process of proper stewardship has to be learned in a continuously innovative fashion and a social learning frame of mind. The N.C.C. could therefore use the various sectors of the Greenbelt as heuristic devices to demonstrate the journey of sustainable development.

In "Towards Sustainable Land Use: A Strategy," E.W. Manning targets the problem of population expansion into arable land: "Nearly two thirds of all urban growth in Canada from 1966 to 1976 occurred on high capability agricultural land.... From 1976 to 1981, more than half of all urbanization occurred on class 1, 2, or 3 agricultural lands (p. 18)."

Similar to Richardson, he criticizes the piecemeal approach to land planning in Canada: "The past history of land planning and soil conservation efforts... has been one of short-term responses to particular crises, and has generally occurred strictly within the affected sectors and often then to a limited degree (p. 24). Among priority areas for land research, Manning stresses clarification of the relationship of land to broader societal goals - e.g. survival, profit, sustainability (p. 32).

Finally, in a chart on environment and economy relationships for selected uses of resource lands, that writer postulates the challenge of finding profitable land uses which are sustainable in the long run. This linkage has not yet been achieved. But, as Brown indicated, the growing market for recycled goods might well approximate, if not actually occupy, that spot in the not too distant future.

APPENDIX IV:

THE NATIONAL CAPITAL COMMISSION MANDATE

a) Making the Capital into Canada's meeting place by encouraging the active participation of Canadians in the evolution of their Capital;

b) Using the Capital to communicate Canada to Canadians in order to assist in the development and highlighting of Canadian national identity;

c) Safeguarding and preserving the Capital for future generations.

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